

Physics Advisory Committee

November 12-14, 2009

Draft Charge

The focus of this meeting of the Physics Advisory Committee (PAC) will be on the Intensity and Cosmic Frontiers at Fermilab. We have received one new proposal, a letter of intent, an expression of interest, and an update on a proposal for research at the Intensity Frontier, and six proposals for experiments at the Cosmic Frontier. Given the number of such items on the agenda, we have had to curtail status reports on much of the current program to allow significant time for discussion of the above items. Nevertheless, given the recent CMS Upgrade Workshop at Fermilab (October 28-30), it seems appropriate to review the progress in this area at this time too.

We would like to receive written comments and recommendations on each of the above items as detailed by topic below.

1. CMS Upgrade

The PAC will have a report on the CMS Upgrade Workshop and the current state of planning for the first phase of the CMS Upgrade. We request the PAC to comment on the outcomes of the recent CMS Upgrade Workshop and the anticipated roles for US CMS and Fermilab. Are the strengths of the US CMS community and Fermilab appropriately recognized in planning for the first phase upgrade? Are there areas where current capabilities would need to be strengthened to achieve the goals of this first-phase CMS upgrade?

2. Design and Cost Update for New g-2 (P-989)

The Laboratory received a proposal for a New g-2 Experiment at Fermilab. The proposal was first presented to the PAC at its March, 2009 meeting. The New g-2 Collaboration has submitted two documents detailing recent work, and updating the situation with regard to this proposal. The PAC is asked to review the current understanding of the discrepancy between the measurement of $(g-2)$ and updated theoretical estimates. In light of this understanding, how strong is the continuing interest in an improved measurement? The updates received from the New g-2 Collaboration also respond to issues raised by the PAC in its last review, and the PAC is asked to comment on both the revised cost estimates and other issues that the PAC raised. It is still true that the Laboratory will need to understand its future funding before making any further decisions on the Proposal.

3. Measurement of the $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ Decay at Fermilab (P-996)

The Laboratory has received a proposal to measure the decay rate of $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ at Fermilab. The measurement would make use of the Tevatron as a beam-stretcher following completion of the current Collider program. Clearly, there is a benefit in an expeditious decision on this proposal – particularly if we are to proceed, since maintaining the Tevatron as a viable option for such a future program entails specific planning and costs. The PAC is asked to comment on the experiment envisioned in the proposal, and to compare it to competing efforts elsewhere in the world. Are the techniques proposed credible for making the measurement and for reaching the sensitivity goals of the experiment? Could the proposed experiment be competitive and important to the field? Could the experiment be important in understanding signals suggesting new physics which could be seen at the Tevatron or the LHC? What other benefits and risks does the PAC see in approval of such an experiment? Would such an experiment provide additional opportunities for further use of the Tevatron, and are there obvious physics motivations for such experiments?

4. Letter of Intent to Build a MiniBooNE Near Detector: BooNE (P-1002)

The Laboratory has received a Letter of Intent following up on the Expression of Interest submitted to the Laboratory and seen by the PAC at its June meeting. We would appreciate any comments the PAC may have about the motivations for the measurements discussed. Should the proponents be encouraged to proceed to a full proposal? If so, does the PAC have any comments about the choice among methods suggested for these measurements? In particular, is building a second detector commensurate with the goals of the measurements and interest in the expected results from such an experiment?

5. SciNOvA: A Measurement of Neutrino-Nucleus Scattering in a Narrow-Band Beam (P-1003)

The Laboratory has received an Expression of Interest for resurrecting the SciBar detector and moving it to the cavern to be built for the near detector of NOvA. The PAC has this proposal, and also will hear a presentation on this opportunity. The PAC is asked to comment on this proposal; in particular:

Are the potential contributions to physics commensurate with the modest effort required for such an experiment?

Should the proponents be encouraged to proceed to a full proposal?

6. Strategic Planning for Research at the Cosmic Frontier

The PAC will hear about Fermilab's strategic planning for research at the Cosmic Frontier, and about the recently released report of the Particle Astrophysics Science Assessment Group (PASAG). Does the strategic planning done within the Fermilab Center for Particle Astrophysics provide a basis for reviewing the proposals at this Frontier, both those which have

been submitted in time for this PAC meeting and those anticipated in the nearer-term future? Are Fermilab's plans aligned with the recommendations of the PASAG?

For each of the particle astrophysics proposals received, we ask the PAC to comment on the following issues (in addition to any proposal-specific questions listed separately):

- In the context of the PASAG recommendations, is the science in the proposal interesting and/or compelling today?
- How does the proposed experiment relate to Fermilab's mission?
- Could/should the proposed experiment be part of a coherent Fermilab particle astrophysics program?
- What is the competition for reaching the physics goals of the proposed experiment? Does the proposed experiment have particular advantages or disadvantages relative to the competition?
- What is unique about Fermilab and its proposed role in the experiment? Is the proposed Fermilab role appropriate and significant?
- What is needed to make such an experiment successful? Is Fermilab necessary for the experiment to succeed?

7. Auger North (P-997)

The Auger Observatory collaboration has submitted a proposal to the NSF, and anticipates submitting one to the DOE as well, to build a second observatory, this one in the Northern Hemisphere. The proposal involves Fermilab playing significant roles in such a new observatory, similar to what it did and continues to do for the observatory in Argentina. This is described in the document made available to the PAC. The above questions are relevant to this proposal, and the PAC is asked to comment on them and on the proposal for Fermilab to participate as requested.

8. The Fermilab Holometer: A Program to Measure Planck Scale Indeterminacy (P-990)

The Laboratory has received an updated proposal, now titled "The Fermilab Holometer: A Program to Measure the Planck Scale Indeterminacy". The new document includes responses to questions raised by the PAC at its first consideration of the proposal to build such an interferometer. The PAC is asked to comment on the responses to its questions, as well as the general questions above.

9. QUIET Phase II – The Search for B-Mode Polarization in the Cosmic Microwave Background Using Coherent HEMT Detectors (P-998)

A proposal for QUIET Phase II, a fifteen-fold increase in the QUIET Phase I experiment on polarization of the cosmic microwave background, has been submitted to the NSF. Fermilab scientists are proposing to join this experiment and contribute to the science, assembly of the detectors, help with procurement, and other collaboration efforts. Again, the above questions should be addressed.

10. A Proposal to Operate the COUPP-60 Bubble Chamber at SNOLAB (P-999)

The COUPP E-961 Collaboration is preparing to move its new 60 kg detector underground to the NuMI tunnel. In addition, the Collaboration is proposing to move the detector later to a deeper underground site at SNOLAB. The PAC is asked to comment on the progress being made by the COUPP E-961 Experiment (for the approved on-site measurements), and the prospects for the measurements being made (E-961) and proposed (P-999 for a SNOLAB-sited experiment). In commenting on the progress being made, the PAC is asked to review the goals and plans to put the 60 kg detector in the NuMI tunnel. This should be done in the context of DOE interest in a “reviewable” document to justify the request for funding in this fiscal year. Again, the above general questions should be addressed.

11. DarkSide (P-1000)

The DarkSide Collaboration has submitted a proposal to the NSF, and anticipates submitting one to the DOE as well, to build a 50 kg argon dark-matter detector. The proposal involves Fermilab playing significant roles in such a new effort; including technical assistance and engineering for some parts, major responsibility for others, and also a role in project management. Again, the above general questions should be addressed.

12. MAX – Multi-Ton Argon and Xenon Detector R&D (P-1001)

The MAX Collaboration (closely related to the DarkSide Collaboration) has been successful in its proposal to the NSF to develop multi-ton argon and xenon dark-matter detectors as part of the S4 Solicitation associated with DUSEL. Fermilab was supportive of this proposal, and wrote that the Laboratory would “provide further engineering and technical resources, along with scientific staff.” In the proposal to the NSF there is “a significant role for Fermilab, where ... collaborators have close connections to the liquid argon program for long-baseline neutrino oscillation studies for DUSEL.” The PAC is asked to comment on the priority that the Fermilab commitment should have, and the nature and extent such support should optimally take. Again, the above general questions should be addressed.

13. Workshop on Physics with a High-Intensity Proton Source

Some members of the PAC are expected to attend the “4th Workshop on Physics with a High-Intensity Proton Source” early in the week of the PAC meeting. The PAC is asked to comment on the content of the draft “White Paper” which is to be an outcome of the Workshop. Are there areas that have been ignored or are less advanced relative to others, areas deserving of more emphasis, etc? Are there any suggestions about the material already in the draft document?

14. Workshop on Muon Collider Physics, Detector and Machine Background

Some members of the PAC are expected to attend the “Workshop on Muon Collider Physics, Detector and Machine Background” during the week of the PAC meeting. The PAC will also attend the summary session of the Workshop, and is asked to comment on the status of thinking about the physics of a muon collider experiment. Are there areas that have been ignored or are less advanced relative to others, given the status of such thinking?